



Crude oil (petroleum) is the only naturally liquid fossil fuel. The word "petroleum" means "rock oil" or "oil from the earth."

Crude oil is obtained from wells drilled into oil reservoirs beneath the soil surface. "Natural lift" production methods that rely on the natural reservoir pressure to force the oil to the surface are usually sufficient for a while after reservoirs are first tapped. The natural pressure in many reservoirs, however, eventually dissipates. Then the oil must be pumped out using "artificial lift" created by mechanical pumps powered by gas or electricity. Over time, these "primary" methods become less effective and "secondary" production methods may be used.

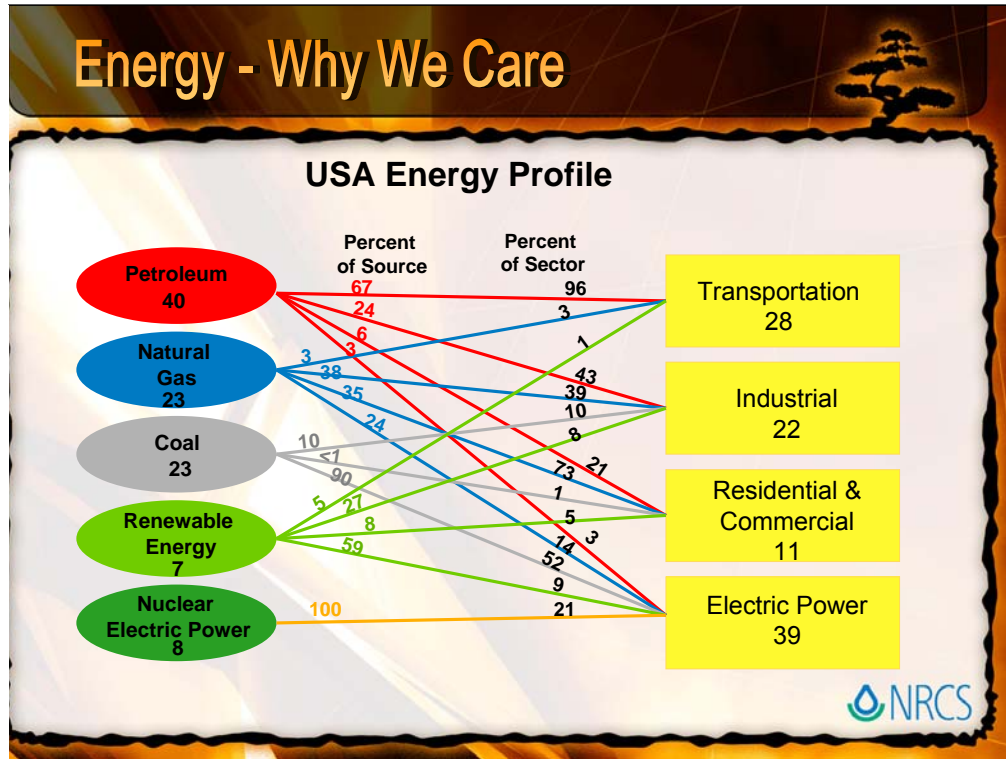
Crude oil production has been declining in the United States while demand has been increasing.

**NOTE: figure came from Department of Energy web site.
<http://www.eia.doe.gov/kids/energyfacts/sources/non-renewable/oil.html#How%20used>**

Energy - Why We Care



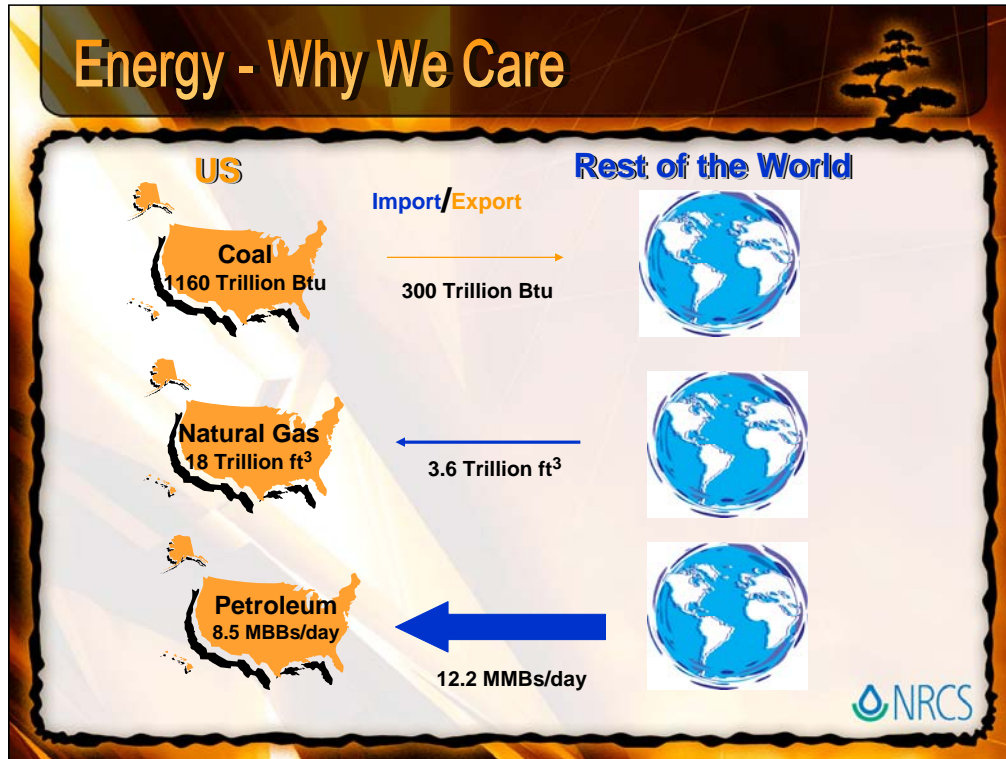
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-Use this slide to put in context what you use the various forms of energy for (ie. To what sector are they associated with). This will help to explain why we are in such a dilemma in this country and the world also.

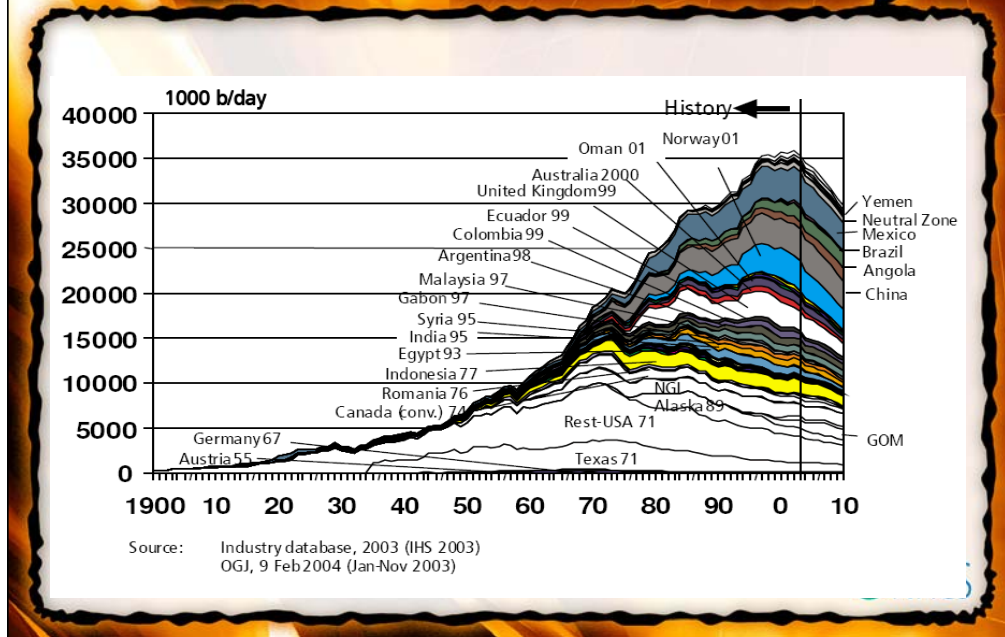
-Get them to guess the percentage of each energy source.

-Then point out the relationship between petroleum and transportation. (ie. We are highly dependent on liquid petroleum for transportation). How about coal and electricity? What problem does this pose (We have plenty of it but the CO2 issue)



- The United States of America is the world's largest energy producer, consumer, and net importer. It also ranks eleventh worldwide in reserves of oil, sixth in natural gas, and first in coal.
- The U.S. has the world's largest coal reserves, with the Western U.S. accounting for 55 percent of current U.S. coal production.
- This time last year, U.S. coal was going for \$42 or so per ton. Now, it's over \$100.
- The U.S. has more than a 200-year supply of coal.
- The U.S. is the world's largest consumer and second-largest producer of natural gas.
- United States is currently consuming 25% of the world's oil when the U.S. is only 5% of the population
- Americans consumes 3 times more oil than they produce
- U.S. oil consumption is at record breaking levels - 20.7 million barrels per day
- Mention where our imported oil comes from
- In 1994, the world demand for oil was thought to have peaked at 66 – 68 million barrels per day (MMB/D). Instead, it grew to over 88 MMB/D by early 2008 and continues to rise.
- Demand growth came despite ten-fold rise in oil prices.
- China and India are on the march to prosperity. Their 2.4 billion people want to drive cars. This unplanned growth used up 99% of world's spare capacity.
- Discuss Speculation vs. demand and supply

Energy - Why We Care



•Dr. M. King Hubbert, a geophysicist, predicted in 1956 that U.S. oil production would peak in about 1970 and decline thereafter. He was scoffed at then but his analysis has since proved to be remarkably accurate. In fact the production maximum occurred in 1971. Hubbert based his forecast on the fact that the maximum of new discoveries had already passed, therefore he could estimate the remaining amount of oil to be found with some accuracy. Combining this with an extrapolation of the oil production, he was able to predict the production peak. After about half of the recoverable oil had been produced, the maximum had been reached.

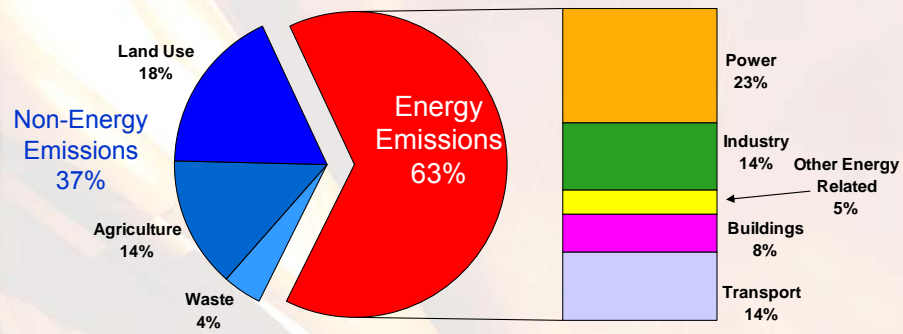
In the history of oil production, which is now extending over more than 150 years, we can identify some fundamental trends:

- The world's largest oil fields were all discovered more than 50 years ago.
- Since the 1960's, annual oil discoveries have decreased tendentially. The historical maximum of oil discoveries has to be followed after some time by a maximum of oil production (the "peak").
- Since 1980, annual consumption has exceeded annual new discoveries. Till this day more than 42,000 oil fields have been found, but the 400 largest oil fields (1 per cent) contain more than 75 per cent of all oil ever discovered.
- This steady degradation of the quality of the oil produced can be observed in almost all regions having passed the peak and poses an additional challenge for the existing downstream infrastructures: refineries have to be run with oil of increasingly lower quality. The supply share of lesser oil qualities is steadily increasing – this causes additional pressure on the price for the remaining good oil grades.
- The study "Global 2000" (commissioned by the US President) predicted in 1980 the date for the global production peak to be somewhere near the end of the 20th century. The biggest uncertainty was predicting oil consumption - not forecasting how much oil still can be found. In fact this study has assessed the total existing reserves amazingly precise (as we now know with much greater certainty) - just the development of demand was greatly overestimated.

•Bring up the issue of Energy Security

Energy - Why We Care

Global Emissions by Sector



Total emissions in 2000 42 GtCO₂e



- Not only how much energy is critical but also where that energy will come from is becoming extremely important (ie. Climate change)
- Each type of energy source has its pluses and minuses. The question is which will ultimately trump the other.
- There are all kinds of environmental impacts from producing the various types of energy.
- It will be interesting to see what will become the true measuring stick. More and more it looks like CO₂ equivalents may be it.

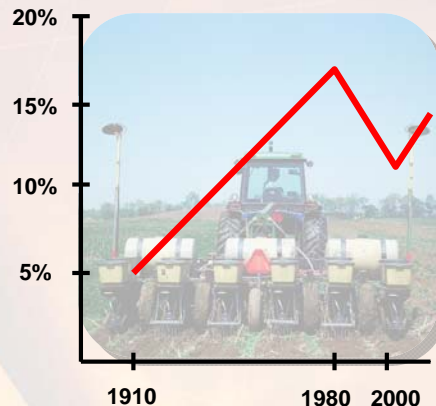
Energy - Why We Care

Real Energy Costs for Farmers

Energy-related expenditures including electricity, fuels and oils, and fertilizers make up an important share of total production expenses.

In 2005 about 14% of farming production costs was energy related:

- Fuel \$11.2 billion
- Electricity \$3.4 billion
- Fertilizer \$12.8 billion



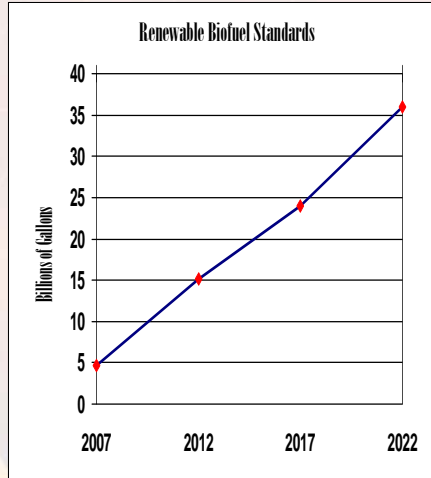
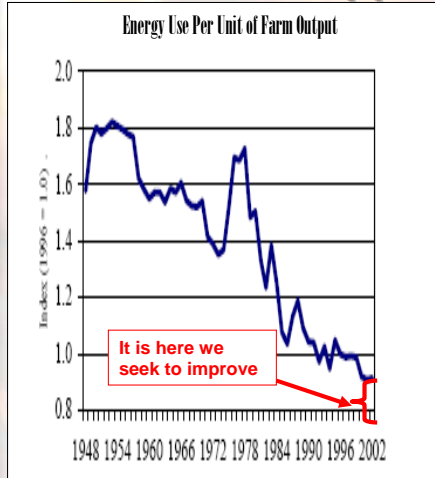
NRCS

- Point out that this varies significantly based on the type of farming and/or ranching operation
- Energy-related expenditures including electricity, fuels and oils, and fertilizers make up an important share of total production expenses.
- Energy-related expenses rose from about five percent of total farm cash expenses in 1910 to over 17 percent of total farm cash expenses in the early 1980s.
- Since the early 1980s, improvements in efficiency and relatively stable nominal energy prices caused the share of energy-related expenses as a share of total farm cash expenses to fall to about 11 percent by 2003. However, due to increasing energy prices, the share of energy-related expenses as a share to total farm cash expenses rose in 2005 to 14 percent. With expenses for fertilizer, fuels and oils, and electricity continuing to increase, energy-related expenses are continuing to climb.

•Farming is an energy-intensive sector. Fuel is used in various forms to fertilize, process, and transport agricultural products. Recent energy hikes and volatility have severely altered the cost and benefits of farming. Currently, 14 percent of farm expenditures are used for energy-related production inputs, a 3 percent increase from a relatively stable period between 1980 to 1999. Farmer's fuel, oil and electricity expenditures increased \$8.6 billion to \$11.5 billion between 1999 and 2005, and fertilizer expenditures increased from 7.9 billion to 11.5 billion during this time, amounting to a total increase of \$4.5 billion of agricultural expenditures towards energy inputs over the last six years¹⁸. Consequently, farmers have lost opportunities to invest and add value to their farm operations. This provides with them with diminished capacity to remain competitive in global and domestic markets.

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Opportunities

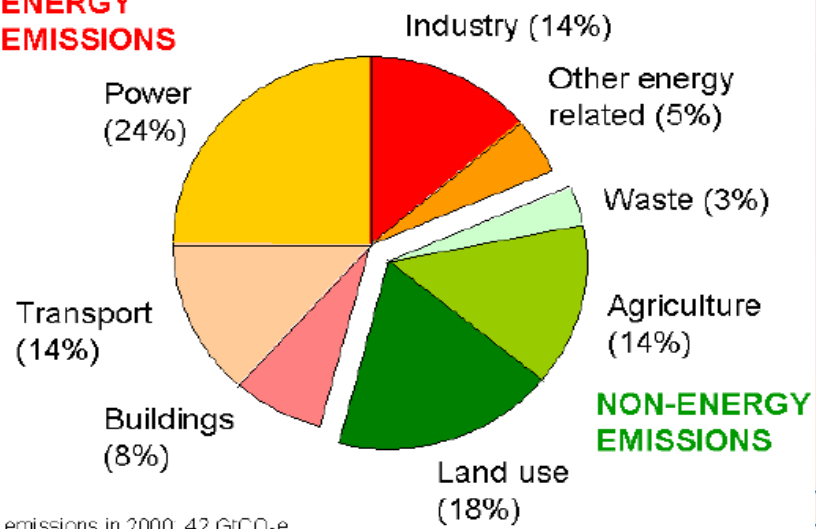


Year	Applicable volume of biofuel required (in billions of gallons)
2006	4.0
2007	4.2
2008	4.7
2009	9.0
2010	11.1
2011	12.9
2012	13.9
2013	15.2
2014	16.5
2015	18.1
2016	20.5
2017	22.2
2018	24.0
2019	26.0
2020	28.0
2021	30.0
2022	33.0

36.0

Energy - Why We Care

ENERGY EMISSIONS



Total emissions in 2000: 42 GtCO₂e.

NON-ENERGY EMISSIONS

Introduction



Oil

Oil production, transportation, refining and combustion all present environmental risks that we don't always think about when we fill up at the pump.

- Drilling can impact both water quality and quantity. The devastation of hurricane Katrina can partly be attributed to land subsidence due to excessive pumping of oil (and water).
- Oil spills and leaking pipelines are common problems associated with oil transport.
- Refineries spew millions of tons of air pollutants into the atmosphere each year.
- Combustion of petroleum products releases air pollutants, especially greenhouse gases..



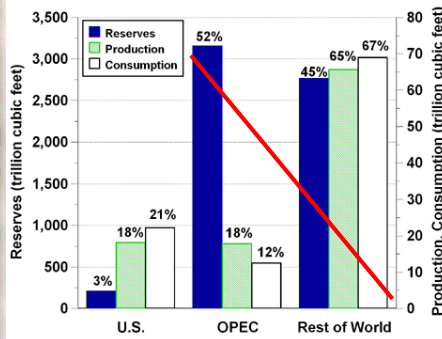
I like the three pictures concept here. The pictures should be for oil, in this case, though.

A tractor or truck might go here



Introduction

Natural Gas



Natural gas is the cleanest burning fossil fuel. Composed primarily of methane gas, it also contains other gases such as propane and butane. Natural gas is stored in tanks or old gas or oil wells until needed. At very low temperatures, natural gas can also be stored and transported in liquid form as liquid natural gas (LNG).

The US uses more natural gas than we produce. In 2005 we produced 18% of the world's natural gas, but we consumed 21%. Even more telling is the level of our natural gas reserves.



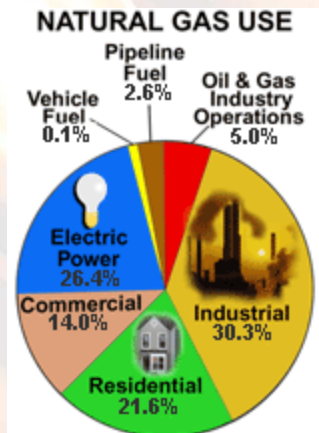
Natural gas is the cleanest burning fossil fuel. Natural gas is composed primarily of methane gas, but it also contains other gases such as propane and butane. Natural gas typically flows from wells under its own pressure. It is collected by small pipelines that feed into the large gas transmission pipelines, and stored in tanks or old gas wells until needed. At very low temperatures, natural gas can also be stored and transported in liquid form as liquid natural gas (LNG).

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Introduction



Natural Gas



Natural gas is used to produce heat and electric power. It is also an essential raw material for products such as plastics, medicines, paints and fertilizers.

Because natural gas is a key ingredient in nitrogen fertilizer production, it is a critically important energy source for many agricultural producers.



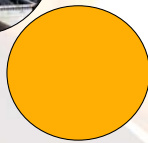
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Introduction



Natural Gas

Rather than using arrows, these could be roll-over pictures.



haps a natural
furnace in a
cken house

Natural gas is the cleanest burning of the fossil fuels, but it still poses air and water quality risks:

- Natural gas exploration involves drilling of many exploratory wells, increasing water contamination risk.
- Environmental leaks from transportation and storage of natural gas do occur.
- Natural gas itself contains a potent greenhouse gas, methane. Burning natural gas releases CO₂ and other pollutants into the atmosphere.



Introduction



Coal



Coal is mined from deep or shallow deposits. The United States has the world's largest known coal reserves, about 267.6 billion short tons. This is enough coal to last approximately 236 years at today's level of use. West Virginia and Wyoming lead the nation in coal production, although coal is mined in at least half of the states.

Although technological improvements have reduced the impact, coal is still an inefficient energy source and can be a serious air and water pollutant.





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Photo source: DOE


Introduction

Coal



Over 90% of the coal mined the United States is used to generate electricity. Except for a small amount of net exports, the rest of the coal is used as a basic energy source in many industries, including, steel, cement and paper.

Coal is used indirectly in agriculture, as much of the electricity used to power agricultural equipment is produced through combustion of coal.



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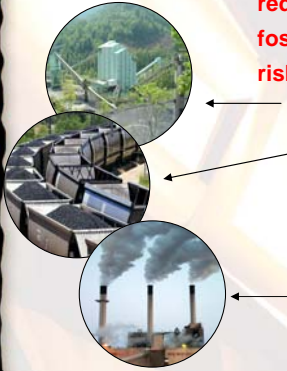

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Introduction

Coals impact on environment

Environmental laws and new technologies have greatly reduced the impact of coal on the environment. Still, of all the fossil fuels mentioned, coal poses the greatest environmental risks.

- Without proper care, mining can destroy land and pollute water.
- Transportation of coal from the mining site to where it is used causes the release of CO₂ and other air pollutants into the environment.
- Burning of coal produces emissions of CO₂ as well as SO₂, NO_x and mercury. Scrubbers installed in newer power plants can reduce but not eliminate these emissions.

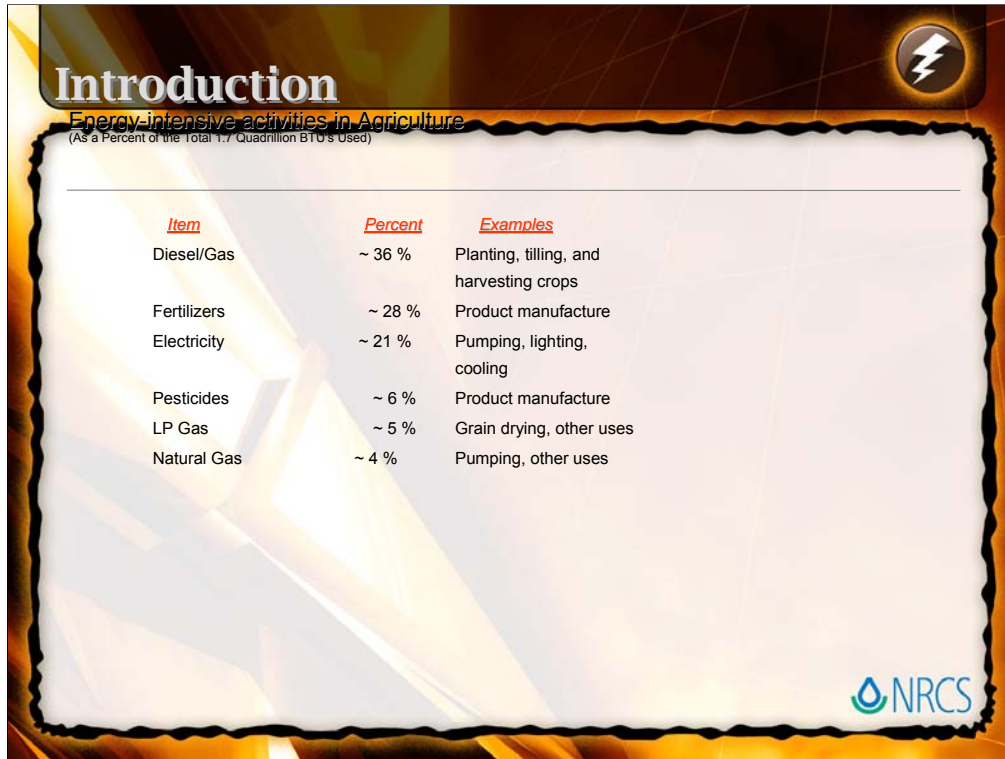
Coal pollutes when it is mined, transported to the power plant, stored, and burned.

Without proper care, mining can destroy land and pollute water. Because mining activities often come into contact with water resources coal producers must take extra care to reduce the risk of water pollution. Restoration of mined land is now an important part of the mining process.

The transportation of the coal itself and the waste products of coal being transformed into electricity also causes the release of CO₂ into the environment. The dumping of the waste products also has a large impact on the land and water in the area where it is disposed.

When coal is burned as fuel, it gives off carbon dioxide, the main greenhouse gas that is linked with global warming. Burning coal also produces emissions, such as sulfur, nitrogen oxide (NO_x), and mercury, that can pollute the air and water. Sulfur mixes with oxygen to form sulfur dioxide (SO₂), a chemical that can affect trees and water when it combines with moisture to produce acid rain. Emissions of nitrogen oxide help create smog, and also contribute to acid rain. Mercury that is released into the air eventually settles in water. The mercury in the water can build up in fish and shellfish, and can be harmful to animals and people who eat them. The Clean Air Act and the Clean Water Act require industries to reduce pollutants released into the air and the water.

The coal industry has found several ways to reduce sulfur, nitrogen oxides, and other impurities from coal. They have found more effective ways of cleaning coal before it leaves the mine, and coal companies look for low-sulfur coal to mine. Power plants use "scrubbers" to clean sulfur from the smoke before it leaves their smokestacks. In addition, industry and government have cooperated to develop "clean coal technologies" that either remove sulfur and nitrogen oxides from coal, or convert coal to a gas or liquid fuel. The scrubbers and NO_x removal equipment are also able to reduce mercury emissions from some types of coal. Scientists are working on new ways to reduce mercury emissions from coal-burning power plants, since the Environmental Protection Agency (EPA) has set tighter mercury limits for the future.

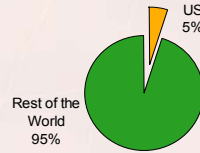


Original data had diesel 27% and gas 9%

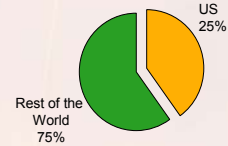
Energy - Why We Care

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World Population



Oil Consumption



Where U.S. Oil Is From

